Cambridge Assessment International Education

Cambridge O Level

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **October/November 2020**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Mathematics Specific Marking Principles

1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	625.6[0]	**2**	**M1** for [2 ×] 340×0.92 oe or **B1** for 54.4[0] in working
1(b)	210	**2**	**M1** for $\frac{100+15}{100}x = 241.50$ soi
1(c)	3.7	**2**	**B1** for answer figs 37 or **M1** for $\frac{29.6}{800} \times 100$ oe
1(d)	90	**3**	**M1** for 450×0.82 soi **M1** for $\frac{[\textit{their}\ 369-]297}{0.80}$ oe
2(a)(i)(a)	188 to 189	**1**	
2(a)(i)(b)	37 to 39	**2**	**B1** for 207 to 208 or 169 to 170 seen
2(a)(ii)			**M2** for $\frac{60-52}{60}[\times 100]$ oe or $\frac{52}{60} \times 100$ oe or **M1** for reading graph at 220 g
2(a)(iii)	B, IQR is smaller oe	**1**	Strict **FT** *their* **2(a)(i)(b)**
2(b)	130 or 129.5 to 129.6	**3**	**B1** for correct midpoints soi **M1** for $(10 \times 90 + 15 \times 110 + 42 \times 125 + 36 \times 135 + 17 \times 170) \div 120$
2(c)	26.105	**3**	**B1** for 605 g oe or 2.55 kg oe soi **M1** for $10p + b$ where $2.4 \leqslant p \leqslant 2.6$ and $0.59 \leqslant b \leqslant 0.61$
3(a)(i)	Correct triangle with intersecting arcs	**2**	**B1** for acceptable vertex R indicated with no/incorrect arcs After 0 scored, **SC1** for triangle with $P = 6$ cm and $QR = 7.5$ cm with intersecting arcs

Question	Answer	Marks	Partial Marks
3(a)(ii)	20.8 to 21.6	**2**	**M1** for $\frac{1}{2}\times 8\times$ *their* height oe or $\frac{1}{2}\times 8\times 7.5\times \sin$ *their* 45 or $\frac{1}{2}\times 8\times 6\times \sin$ *their* 63 or $\frac{1}{2}\times 6\times 7.5\times \sin$ *their* 72
3(b)(i)	39.7 or 39.70...	**3**	**M2** for $[\sin =]\frac{3.8\times \sin 63}{5.3}$ or **M1** for $\frac{3.8}{\sin[...]}=\frac{5.3}{\sin 63}$ oe
3(b)(ii)	30.5 or 30.51 to 30.52	**3**	**M2** for $[\cos =]\frac{6.4^2+9.7^2-5.3^2}{2\times 6.4\times 9.7}$ or **M1** for $5.3^2=6.4^2+9.7^2-2\times 6.4\times 9.7\times\cos[...]$
4(a)	0.1 oe	**1**	
4(b)	Correct smooth curve	**3**	**B2FT** for 6 or 7 points correctly plotted or **B1FT** for 4 or 5 points correctly plotted
4(c)	Tangent drawn at (2, 3.2)	**B1**	
	1.8 to 2.4	**B1**	Dependent on close attempt at tangent
4(d)	0.25 to 0.4	**1**	
5(a)	6.67 or 6.672 to 6.673	**3**	**M2** for $\frac{1}{2}\times(2.25+1.85)\times 1.55\times 2.1$ oe or **M1** for $\frac{1}{2}\times(2.25+1.85)\times 1.55$ oe or $\frac{1}{2}\times 1.55\times 2.1\times(2.25-1.85)$ oe
5(b)	1.68 to 1.681...	**4**	**M2** for $[DC=]\sqrt{1.55^2+(2.25-1.85)^2}$ oe or **M1** for $[DC^2=]\ 1.55^2+(2.25-1.85)^2$ oe AND **M1** for $\left[\frac{1}{2}\times\right]$ *their* 1.601×2.1 oe

Question	Answer	Marks	Partial Marks
5(c)	40.8 or 40.76…	**4**	**M2** for $[AF =]\sqrt{1.55^2 + 2.1^2}$ oe or **M1** for $[AF^2 =]\ 1.55^2 + 2.1^2$ oe AND **M1** for $\tan[\ ] = \frac{2.25}{their AF}$ oe soi
6(a)	$x > 1.5$ oe final answer	**2**	**M1** for $6x + 2x > 5 + 7$ or better After 0 scored, **SC1** for answer […]1.5 oe
6(b)	$4n + 3p = 17.5[0]$ $2n + 5p = 14$	**B1**	
	Correct method to eliminate one variable	**M1**	**FT** *their* equations
	$n = 3.25$ $p = 1.5[0]$	**A2**	**A1** for either $n = 3.25$ or $p = 1.5[0]$ Or after **A0**, **SC1** for a pair of values that satisfy either equation or for correct answers with no working
6(c)(i)	$\frac{x(x-5)-3(x+2)}{(x+2)(x-5)}[=4]$	**M1**	Use of common denominator
	$x^2 - 5x - 3x - 6 = 4x^2 + 8x - 20x - 40$ or better	**M1**	Correct elimination of fractions and expansion of brackets
	Correct completion to $3x^2 - 4x - 34 = 0$ **AG**	**A1**	**A0** if any errors or omissions in working
6(c)(ii)	$\frac{-(-4) \pm \sqrt{(-4)^2 - 4\times3\times-34}}{2\times3}$ or $\frac{2}{3} \pm \sqrt{\frac{106}{9}}$	**B2**	**B1** for $\sqrt{(-4)^2 - 4\times3\times-34}$ or for $\frac{-(-4) \pm \sqrt{their\ 424}}{2\times3}$ or for $3\left(x - \frac{2}{3}\right)^2$ oe
	4.1[0], –2.77	**B1**	
7(a)	60° nfww	**3**	**B1** for $\angle DOB = 136°$ soi **B1** for $\angle BCD = 112°$ soi **M1** for $\angle CDO = 360 - their\ 136 - their\ 112 - 52$ Alternative method **B1** $\angle COB = 76°$ soi **B1** $\angle COD = 60°$ or $\angle OCD = 60°$ soi **M1** $\angle CDO = \angle OCD$ or $\angle CDO = (180 - their\ 60) \div 2$ **Max 2 marks if answer incorrect**

Question	Answer	Marks	Partial Marks
7(b)(i)	106 to 106.1	**4**	**M1** for $[2\times]\frac{40}{360}\times\pi\times6^2$ soi **M1** for $\frac{40}{360}\times2\times\pi\times6\times5$ soi **M1** for $[2\times]\,5\times6$ soi
7(b)(ii)	11.7 to 11.8	**2**	**FT** *their* **(b)(i)** ÷ 9 **B1** for $\sqrt[3]{\frac{1}{27}}$ or $\sqrt[3]{27}$ soi
8(a)	$\frac{n}{35}$ and $\frac{35-n}{35}$ oe correctly positioned on tree diagram	**2**	**B1** for each
8(b)	$\frac{n}{36}\times\frac{36-n}{35}$ oe	**1**	
8(c)	$\frac{n}{36}\times\frac{36-n}{35}=\frac{1}{7}$	**M1**	**FT** *their* **(b)** provided both probabilities in terms of n
	Correct rearrangement to $n^2 - 36n + 180 = 0$ **AG**	**A1**	**A0** if any errors or omissions in working
8(d)	$(n - 6)(n - 30)$ [= 0]	**B1**	Or $\frac{36\pm\sqrt{36^2-4\times180}}{2}$
	6, 30	**B1**	
8(e)	$\frac{29}{42}$ final answer	**3**	**B1** for use of $n = 6$ **M1** for $\frac{36-their\,6}{36}\times\frac{35-their\,6}{35}$ oe
9(a)(i)	$\begin{pmatrix}-8\\4\end{pmatrix}$	**1**	
9(a)(ii)	8.94[4...] nfww	**2**	**M1** for $(their-8)^2+(their\,4)^2$ oe
9(a)(iii)	$\begin{pmatrix}1\\4\end{pmatrix}$	**2**	**B1** for one component correct or for (1, 4) seen or **B1FT** for $\begin{pmatrix}-4\\2\end{pmatrix}$
9(b)(i)(a)	2**p**	**1**	
9(b)(i)(b)	**p** + **q**	**1**	

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Question	Answer	Marks	Partial Marks
9(b)(ii)	$\frac{3}{2}\mathbf{p}+\mathbf{q}$ oe simplified vector final answer	**2**	**B1** for $\overrightarrow{FX}=\frac{3}{2}\mathbf{p}$ soi or $\overrightarrow{BX}=-\frac{1}{2}\mathbf{p}$ soi or **M1** for a correct vector route along the lines of the diagram
9(b)(iii)	$\frac{1}{2}\mathbf{p}+\frac{4}{3}\mathbf{q}$ oe simplified vector final answer	**3**	**B2** for answer $k\mathbf{p}+\frac{4}{3}\mathbf{q}$ or $\frac{1}{2}\mathbf{p}+k\mathbf{q}$ or correct unsimplified vector or for $\overrightarrow{FY}=2\mathbf{p}+\frac{4}{3}\mathbf{q}$ oe or **M1** for $\overrightarrow{FY}=k\overrightarrow{OX}$ soi or for correct route for $\overrightarrow{XY}$
10(a)	2.2 oe	**1**	
10(b)	$\frac{3-5x}{2}$ oe final answer	**3**	**B2** for $2y=3-5x$ or $[x=]\frac{3-5y}{2}$ or $[x=]\frac{5y-3}{-2}$ or $y+\frac{5x}{2}=\frac{3}{2}$ or **B1** for correct first step e.g. $x=\frac{3-2y}{5}$ or $5y=3-2x$
10(c)	3	**3**	**M2** for $5p-35=12-8p-8$ or better or **M1** for $\frac{p-7}{4}=\frac{3-2(p+1)}{5}$

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